IMPLEMENTATION OF BUSINESS MODELS FOR RENEWABLE ENERGY AGGREGATORS: EXPERIENCE FROM THE EUROPEAN PROJECT BESTRES

TOPIC 7: PV ECONOMICS, MARKETS AND POLICIES
SUB-TOPIC 7.1: PV ECONOMICS AND MARKETS

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ABSTRACT

The electricity market landscape is changing because the growth in renewable energy is increasing the share of intermittent electricity and price volatility in the power system. In this framework, the market integration of intermittent electricity from renewable energy sources cannot be achieved by single individual, commercial or domestic consumers since they would only have a limited impact. It is only through a coordinated steering of vast amounts and types of consumers and producers that the use of distributed generation, demand side management and energy storage can be effective. This coordination action can be performed by facilitators such as renewable energy aggregators, which can accelerate the integration of intermittent electricity sources, enhance demand flexibility and decrease the reliance on renewable energy support schemes.

"Renewable energy aggregators are legal entities that aggregate the load or generation of various demand and or generation / production units and aim at optimizing energy supply and consumption technically and/or economically"

In that context, the project BestRES "Best practices and implementation of innovative business models for renewable energy aggregators" has developed innovative business models for integration of renewable energy sources by aggregating distributed generation such as wind, PV, biogas, biomass, hydro, Combined Heat and Power (CHP) and combining this with demand side management and energy storage. The development of the business models has been based on an analysis of the current barriers for aggregators and the suggestion of ways for improving the role of aggregators in future electricity market designs. Existing European aggregation business models found within and outside the project consortium have been analysed, considering technical, market, environmental and social benefits. This analysis has highlighted the importance of aggregators, who act on behalf of consumers and use technological solutions and ICT (Information and Communication Technology) for optimization, to bring aggregation to the market. Based on the analysis undertaken, the existing European aggregation business models have been improved and, at the time being, some of them are under implementation in real life condition.

The first results related to the implementation of the BestRES business models under real life condition will be presented during the EUPVSEC in Brussels, Belgium, in September 2018.

The BestRES project is a European project, co-financed by the European Commission under H2020 Programme. The project started on 1st March 2016 and will end on 28th February 2019. It involves 11 European partners across 9 different European Countries: United Kingdom, Belgium, Germany, France, Austria, Italy, Cyprus, Spain and Portugal. The main target group, the RES aggregators, are involved directly in the project as partners and they are: Good Energy from UK, Next Kraftwerke Germany (targeting Germany, Italy and France), Next Kraftwerke Belgium targeting Belgium, oekostrom from Austria and EDP (targeting Spain and Portugal). The Consortium includes renewable energy experts (3E and TUW-EEG), 1 legal expert (Foundation for Environmental Energy Law / Stiftung Umweltenergierecht – SUER), 1 dissemination-communication expert (youris.com) and 1 research centre (FOSS). The project is coordinated by WIP – Renewable Energies.

Detailed information on the BestRES project is available at the project website: http://bestres.eu

Keywords: aggregators, business models, policies, renewable energy

1. PURPOSE OF THE WORK AND APPROACH

In a changing electricity market landscape, where the share of intermittent renewable energy in the energy mix is increasing, system flexibility becomes crucial.

In this framework, the market integration of intermittent electricity from renewable energy sources cannot be achieved by single individual, commercial or domestic consumers since they would only have a limited impact. It is only through a coordinated steering of vast amounts and types of consumers and producers that the use of distributed generation, demand side management and energy storage can be effective. This coordination action can be performed by facilitators such as renewable energy aggregators. As part of the solution, the aggregation of renewable energy can significantly accelerate the integration of intermittent electricity sources, complement demand flexibility and decrease the reliance on renewable energy support schemes. Aggregators of demand and/or generation are therefore expected to have an increasingly important role to play in the future.

The BestRES project aims at implementing innovative business models for integration of renewable energy sources by aggregating distributed generation such as wind, PV, biogas, biomass, hydro, Combined Heat and Power (CHP) and combining this with demand side management and energy storage. In order to achieve the overall objective, the work has been structured for achieving the following objectives achieved or to be achieved during the project:

- **Analysis of the existing business models**. The consortium has focused on technical, market, environmental and social benefits that aggregators bring to power markets and systems and the technical, regulatory, and legal barriers preventing optimal deployment of current business models. The consortium has subsequently looked into possibilities for improving business models.
- **Testing of improved business models**. The consortium has improved the business models of selected aggregators in the 9 target countries and will analyze the competitiveness of the improved business models for selected aggregators. A Life Cycle Analysis (LCA) will be also carried out for determining non-economic benefits.
- **Selection of business models for real-life implementation.** The consortium has assessed the feasibility of implementing the business models for each aggregator and defined a pilot implementation plan to identify and attract project participants and implement the business model using real customer data. Special attention will be given to the monitoring and evaluation of the implementation.
- **Recommendations for the uptake of the existing market barriers and for the replication**. This includes an assessment of the impact on RES electricity generation and a development of legal and regulatory recommendations for the target countries and for the replication in countries outside the consortium.

This abstract provides a detailed description of the results achieved until now in the project and on the results to be achieved in the upcoming months to be presented at the EU PVSEC in Brussels, Belgium, in September 2018.

2. SCIENTIFIC INNOVATION AND RELEVANCE

The BestRES projects aims to better integrate renewable energies into the power system with a special focus on market integration. New renewable energy business models that allow aggregators to successfully participate in the market by combining different RES technologies, energy storage, flexible demand and other technologies into a commercially viable product have already been assessed and improved in the first part of the project. At the time being, they are under implementation to proceed then with their evaluation in real life condition. BestRES will foster the full market integration of renewable energy sources, which will increase profitability and reduce reliance on today support schemes. The project will also support the establishment of a robust regulatory framework that encourages investments in the renewable energy sector.

The expected impacts of the project are:
- Successful implementation of business models and full market integration of renewable energy sources beyond support schemes;
- Increase of the hosting capacity of the transmission grid and ancillary services provided to the TSOs through direct implementation of the improved renewable energy business models;
- Assessment of market design for ancillary services across the 9 partner countries, and in particular for implementation of renewable energy aggregators business models;
- Recommendations on market design and on the legal and regulatory framework for creating power systems with flexible demand and improved demand side management;
- Support to policy makers for creating new policy strategies that support the renewable energy aggregator business models and the integration of renewable energy overall.

3. RESULTS AND CONCLUSIONS

During the first phase of the BestRES project, the consortium has assessed existing aggregator business models available at the time being in the European Union highlighting technical, market, environmental and social benefits. Barriers and opportunities for renewable energy aggregation have also been investigated. The existing business models were improved (Table 1) considering the future market designs in the nine target countries: United Kingdom, Belgium, Austria, Italy, Cyprus, Germany, France, Spain and Portugal (Figure 1).

Figure 1 - Countries covered by the BestRES consortium

Table 1 - Description of improved business models

Aggregator	Improved business model
Good Energy (UK)	Automation and control
	"Peer-to-peer" (local) energy matching
Next Kraftwerke Germany (Germany)	Dispatch flexible generation under changing market design on multiple markets
	Supplying „mid-scale" customers with time variable tariffs including grid charges optimization
Next Kraftwerke Germany (France)	Providing decentralized units access to balancing markets
Next Kraftwerke Germany (Italy)	Market renewables on multiple market places
Next Kraftwerke (Belgium)	Trading PV and Wind power
	Using flexibility of customers as third party
Oekostrom AG (Austria)	Demand Side flexibilization of small customers
	Invest and market distributed generation of customers in apartment houses
EDP (Portugal)	Activation and marketing of end user's flexibility.
EDP (Spain)	Activation and marketing of end user's flexibility.
FOSS (Cyprus)	Pooling flexibility for local balancing market and energy service provision

Explanation of the improved business models

- **Automation and control**: Provision of hard- and software solutions allowing customers to automate their devices.
- **"Peer-to-peer" (local) energy matching**: Unite customers and generators on a local level and create value for both.
- **Dispatch flexible generation under changing market design on multiple markets**: Increase value for generators by trading on multiple market places under changing market design, e.g. spot, balancing and reserves markets.
- **Supplying „mid-scale"customers with time variable tariffs including grid charges optimization**: Time variable tariffs (especially grid charges) including monitoring will help consumers to benefit from market signals.
- **Providing decentralized units access to balancing markets**: Distributed generators benefit from portfolio effects.
- **Market renewables on multiple market places:** Forecasting quality can be increased by using live

data and portfolio effects. Valorising pooled generation at dispatch and balancing markets.
- **Trading PV and Wind power:** Market the generation of renewable generators. As an effect of portfolio effects, benefits could be achieved.
- **Using flexibility of customers as third party:** This improved business model aims for customers whose supplier is not marketing flexibility. Flexibility can be valorised by an aggregator without changing the supplier.
- **Demand Side flexibilization of small customers:** Activates demand side potential of customers. Allows a shift to a more integrated energy service provider.
- **Invest and market distributed generation of customers in apartment houses:** this improved business model aims in the market integration of solar generation of customers in apartment houses.
- **Activation and marketing of end user's flexibility**: Flexibility of customers will be activated and valorised on energy markets.
- **Pooling flexibility for local balancing market and energy service provision**: because the Cypriot markets are not opened yet, this improved business model uses aggregation for providing DSO services.

The core of all aggregator business models is creating value and revenues by aggregation. Most aggregator business models (9 out 13 improved business models) aim to valorize aggregation at wholesale, balancing and reserve markets. As Figure 2 illustrates, major changes in the electricity market design can be expected from the "Clean Energy for All Europeans Package": active customers, local energy communities, demand response, balancing markets, dispatching of generation and demand response, redispatching and curtailment. To achieve this transformation, new market participants and business opportunities are desirable.
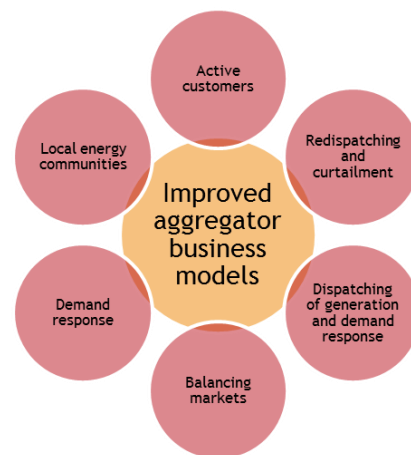

Figure 2 - Future opportunities related to the "Clean Energy for All Europeans Package"

The BestRES consortium has then investigated for each of the improved business models if they are ready for implementation on the basis of an economic feasibility study which led to allocate the business models into three groups:

- **Group 1**: Aggregators with economically viable business models and no substantial legal, social and technical barriers should proceed with real-life implementation with consortium support.
- **Group 2**: Aggregators with economically viable business models but with feasibility issues should proceed with virtual implementation, involving scenario modelling with actual customer data.
- **Group 3**: Aggregators with business models that are not economically viable will not proceed with implementation; however, some commentary on these cases will be provided. Barriers hindering implementation of these models will be identified and discussed.

At the time being, the improved business models ready for implementation are under implementation with real data and monitored. Recommendations will be developed for the replication of the business models in Group 1 and for overcoming the barriers hindering the implementation of the business models in Group 2 and 3. The allocation of the improved business models (BMs) in Group 1, 2 and 3 is shown in Figure 3, 4 and 5.
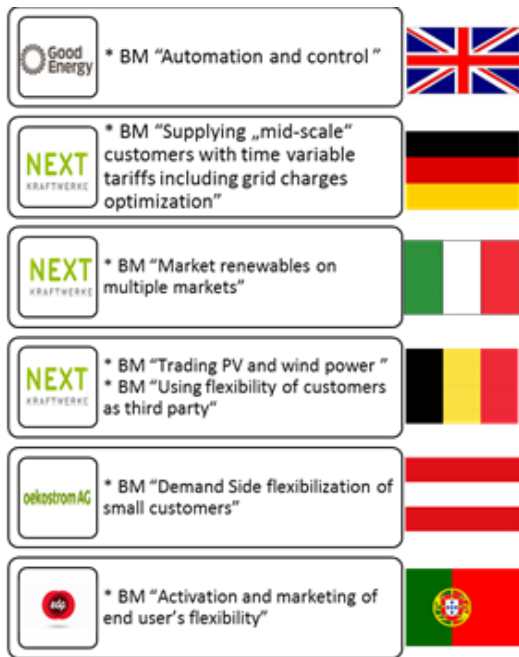

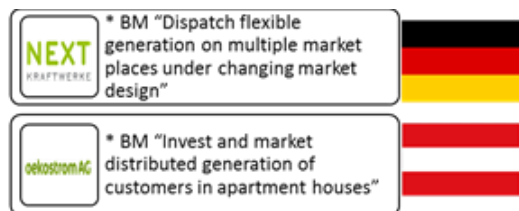**Figure 3 – Allocation of the improved business models (BMs) in Group 1**

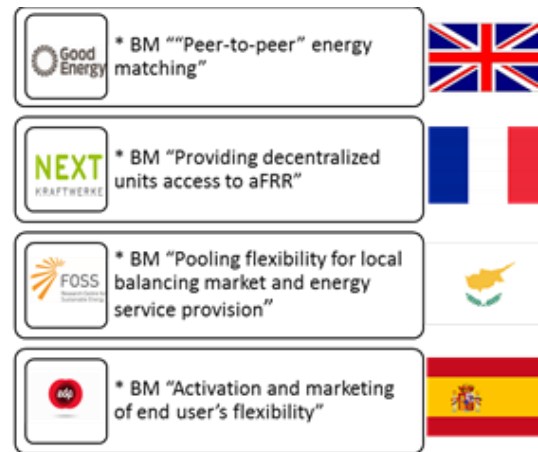**Figure 4 – Allocation of the improved business models (BMs) in Group 2**

Figure 5 – Allocation of the improved business models (BMs) in Group 3

Business models (BMs) ready for implementation (7 out of the 13 BMs) are identified in the United Kingdom, Austria, Germany, Italy, Belgium and Portugal. For group 1 BMs in the United Kingdom and Austria, the aggregator manages to decrease sourcing costs whereas costs (and turnover) to end customers decrease. In Germany, Next Kraftwerke optimizes wholesale and network tariffs. In both Italy and Belgium, Next Kraftwerke generates revenues from fees on reserve power markets. Next Kraftwerke, with another improved BM, also trades weather dependent renewables such as PV and wind on spot markets in Belgium. Finally, in Portugal, EDP uses flexibility from loads to decrease imbalance penalties of the own portfolio.

Two BMs face barriers that prevent direct implementation in the short to medium term (group 2) and four BMs are not feasible (group 3). The research carried out by the BestRES consortium also underlined that almost all BMs that have no significant barriers are ready for implementation. EDP with its BM "Activation and marketing of end user's flexibility" in Spain is the only exception. In this case, although there are no significant technical, legal, regulatory or other barriers for implementation, the BM is not feasible due to low imbalance tariffs. For all other BMs that are not yet ready for implementation, the main hurdles are related to regulation. Therefore, aggregators will only be able to implement these BMs in the medium (group 2) to long (group 3) run.

The proposed improved business models are designed to address future market and regulatory needs.

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